

AIR AND MISSILE DEFENSE

The mission of the U.S. Army Air Defense Artillery (ADA) is to protect the force and selected geopolitical assets from aerial attack, missile attack, and surveillance. At the strategic level, Army ADA supports national missile defense (NMD) and defense of theater strategic priorities. To support the commander's concept of the operation from the theater rear to the forward combat areas, ADA employs an air defense concept that integrates low-, medium-, and high-altitude air defense systems with airborne counter air resources to make the defense effective.

This section describes the survivability of Air and Missile Defense (AMD) systems. It includes the ADA war-fighting concept, the primary threats to the survivability of AMD systems, equipment upgrades and technologies that appear to hold promise for increasing systems survivability, and identifying shortfalls in AMD systems survivability that remain after applying ongoing and planned improvements.

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General. With the national strategy focus on a CONUS-based, force projection military, the defense of early deploying forces against attack by threat missiles and aircraft becomes ever more critical. Army Air and Missile Defense (AMD) has the mission of protecting the force and selected geopolitical assets from aerial attack, missile attack, and surveillance, and provides the key capability for ensuring that air and sea ports of debarkation remain open for use by deploying U.S. forces. In order to accomplish the mission, AMD units and systems must be operationally and physically survivable against a sophisticated array of threat capabilities.

The Threat. AMD systems are faced with a variety of threats to their physical and operational survivability. The threat spectrum includes: Anti-Radiation Missiles (ARMs); Penetration Aids (PENAIIDs), which include Electronic Warfare (EW), Decoys and Target Maneuvers; Nuclear, Biological, Chemical (NBC) Weapons and Agents; Direct and Indirect Fires; Attack Helicopters; Cruise Missiles (CMs); Mass Attacks by Tactical Ballistic Missile (TBMs); Low Observable (LO) Targets; and Intelligence, Surveillance and Reconnaissance (ISR) activities. Each threat poses unique challenges to AMD systems, and each calls for unique responses. Trends in technology to counter the various threats include directed energy weapons (DEW), hit-to-kill technology, multi-function sensor arrays, improved signal and data processing algorithms, signature reduction techniques, improved chemical coatings, and advanced hardening techniques.

AMD Systems. AMD systems are deployed from the forward area of the battlefield, where they provide protection for the maneuver force to the theater rear; in the theatre rear. they defend strategic military and critical geo-political assets. Short range air defense (SHORAD) systems (Stinger, MANPADS, Avenger, Bradley Stinger Fighting Vehicle and Bradley Linebacker), which make up the bulk of the forward area AMD capability, are oriented on defending against helicopters, CMs, unmanned aerial vehicles (UAVs) conducting ISR operations, and close air support aircraft which elude U.S. Air Force interceptors. In the corps and theater rear areas, high and medium altitude (HIMAD) systems (THAAD, PATRIOT and the future MEADS) are deployed to protect the force and critical assets against TBMs, CMs, and manned aircraft that penetrate forward defenses.

Because of their particular technical and operating characteristics, each AMD system has its own susceptibilities and vulnerabilities to different aspects of the threat. SHORAD systems, for example, are highly mobile and are not particularly susceptible to enemy ISR techniques. On the other hand, they will be exposed to the direct and indirect fire threat experienced by the maneuver force. HIMAD systems, deployed further to the rear of the operational area or with the strategic assets, will be threatened by CMs, ISR efforts, and mass attack by TBMs. All active sensors are susceptible to the ARM threat to some degree.

The Way Ahead. Modernizing AMD systems is a highly complex, expensive process that must be planned to integrate technologies that are not only effective and efficient in achieving their design specifications, but are sufficiently maintainable and mobile to support the needs of the forces on the battlefield. The following tables summarize assessments of AMD system survivability in the near (FY01-03), mid (FY04-07) and far (FY08-16) terms. The tables identify known threats to AMD survivability and promising technologies, planned or under development, for countering those threats and listing the remaining survivability shortfalls.

Near-Term (FY 01-03) AD/TMD Survivability Assessment

Threat	Susceptible/Vulnerable Components	Programs/Technologies Scheduled or Available for Fielding During the Near Term	Remaining Survivability Shortfalls
<ul style="list-style-type: none"> • Anti Radiation Missiles 	<ul style="list-style-type: none"> • Radars: Sentinel, Patriot • Control vans in close proximity to radars 	<ul style="list-style-type: none"> • CARM • Software algorithm improvements 	<ul style="list-style-type: none"> • All AD/TMD systems that depend on active radars for mission accomplishment are vulnerable to some degree to attack and damage or destruction by ARMs
<ul style="list-style-type: none"> • Penetration Aids <ul style="list-style-type: none"> - Electronic Warfare - Decoys - Target Maneuvers 	<ul style="list-style-type: none"> • Radars, sensors, seekers 	<ul style="list-style-type: none"> • Radar Enhancement, CDI Phase I & III • Sentinel • Software algorithm improvements 	<ul style="list-style-type: none"> • All IR and RF based AMD radars, sensors, and seekers are susceptible to PENADs
<ul style="list-style-type: none"> • Nuclear, Biological and Chemical Weapons 	<ul style="list-style-type: none"> • Personnel • All equipment 	<ul style="list-style-type: none"> • Improved detection equipment <ul style="list-style-type: none"> - RSCAAL - ACADA - BIDS (NDI System) • Automatic NBC Information System 	<ul style="list-style-type: none"> • No safe/effective means of decontaminating electronic components • Electronics vulnerable to EMP • Personnel effectiveness decreases with use of protective equipment
<ul style="list-style-type: none"> • Direct and Indirect Fire 	<ul style="list-style-type: none"> • Personnel • All equipment 	<ul style="list-style-type: none"> • Bradley Linebacker 	<ul style="list-style-type: none"> • Stinger teams exposed when dismounted from BSFV • BSFV vulnerable to tank/cannon fire • Avenger has no protective armor • HIMAD systems vulnerable to SOF attacks
<ul style="list-style-type: none"> • Helicopters 	<ul style="list-style-type: none"> • All SHORAD systems • Personnel 	<ul style="list-style-type: none"> • STC • Improved FLIR • Software algorithm improvements 	<ul style="list-style-type: none"> • SHORAD sensors/seekers have limited detection ranges against helicopters in clutter • Stinger outranged by stand-off helicopter
<ul style="list-style-type: none"> • Cruise Missiles 	<ul style="list-style-type: none"> • HIMAD systems 	<ul style="list-style-type: none"> • FAADC3I (Block II) with Sentinel and STC • Patriot with CDI Phases I & III • Software algorithm improvements 	<ul style="list-style-type: none"> • Lack of capability to acquire, track and engage CMs using terrain following flight profiles
<ul style="list-style-type: none"> • Mass Tactical Ballistic Missile Attack 	<ul style="list-style-type: none"> • Personnel • HIMAD systems 	<ul style="list-style-type: none"> • PAC-3 missile • Software algorithm improvements 	<ul style="list-style-type: none"> • Mass TBM attacks overwhelm simultaneous engagement capabilities and exhaust missile supplies
<ul style="list-style-type: none"> • Low Observable Targets 	<ul style="list-style-type: none"> • SHORAD and HIMAD sensors and interceptors 	<ul style="list-style-type: none"> • Patriot Radar Enhancements • CDI Phases I & III • Software algorithm improvements 	<ul style="list-style-type: none"> • SHORAD sensor and missile seeker inability to detect and acquire targets in clutter at sufficient ranges • Patriot radar detection capability limited against VLRCS Target
<ul style="list-style-type: none"> • Intelligence, Surveillance, and Reconnaissance 	<ul style="list-style-type: none"> • Active RF sensors • Power generation equipment • All semi static tactical equipment 	<ul style="list-style-type: none"> • None 	<ul style="list-style-type: none"> • HIMAD/FAAD systems easily detected • HIMAD units are limited in mobility; must remain in position for extended periods and have significant IR, visual, and acoustic signatures

Mid-Term (FY 04-07) AD/TMD Survivability Assessment

THREAT	SUSCEPTIBLE/VULNERABLE COMPONENTS	PROGRAMS/TECHNOLOGIES SCHEDULED OR AVAILABLE FOR FIELDING DURING THE MID TERM	REMAINING SURVIVABILITY SHORTFALLS
<ul style="list-style-type: none"> • Anti Radiation Missiles 	<ul style="list-style-type: none"> • Radars: Sentinel (AN/MPQ-64), Patriot, THAAD (UOES) radar • Control vans in close proximity to radars 	<ul style="list-style-type: none"> • THAAD radar • SLID • CARM • Software algorithm improvements 	<ul style="list-style-type: none"> • No active means of defending radars against ARM attack • THAAD (UOES) has vulnerabilities similar to Patriot
<ul style="list-style-type: none"> • Penetration Aids <ul style="list-style-type: none"> - Electronic Warfare - Decoys - Target Maneuvers 	<ul style="list-style-type: none"> • Radars, sensors, and seekers 	<ul style="list-style-type: none"> • Patriot w/CDI Phases I & III • THAAD Radar • ERINT fielded as PAC-3 missile • Sentinel • Vaccines • Software algorithm improvements 	<ul style="list-style-type: none"> • All HIMAD and FAAD systems remain susceptible to PENAIDs
<ul style="list-style-type: none"> • Nuclear, Biological and Chemical Weapons 	<ul style="list-style-type: none"> • Personnel • All Equipment 	<ul style="list-style-type: none"> • Self-stripping decontamination agent • Hit-to-kill interceptors 	<ul style="list-style-type: none"> • Electronic components decontamination still limited • Electronics vulnerable to EMP • Personnel effectiveness decreases with use of protective equipment
<ul style="list-style-type: none"> • Direct and Indirect Fire 	<ul style="list-style-type: none"> • Personnel • All equipment 	<ul style="list-style-type: none"> • Bradley Linebacker • Battlefield Combat Identification • SLID • THEL 	<ul style="list-style-type: none"> • HIMAD systems vulnerable to SOF attacks • SHORAD Systems
<ul style="list-style-type: none"> • Helicopters 	<ul style="list-style-type: none"> • All SHORAD systems 	<ul style="list-style-type: none"> • Software algorithm improvements 	<ul style="list-style-type: none"> • Stinger seeker has limited acquisition range against targets in clutter • Stinger out ranged by stand-off attack helicopter
<ul style="list-style-type: none"> • Cruise Missiles 	<ul style="list-style-type: none"> • All HIMAD systems 	<ul style="list-style-type: none"> • JLENS • Software algorithm improvements 	<ul style="list-style-type: none"> • Lack of capability to acquire, track, and engage CM using terrain following flight profiles • Insufficient systems with anti-CM capability deployed to protect HIMAD and TMD assets
<ul style="list-style-type: none"> • Mass Tactical Ballistic Missiles Attack 	<ul style="list-style-type: none"> • Personnel • HIMAD systems 	<ul style="list-style-type: none"> • PAC-3 missile • Software algorithm improvements 	<ul style="list-style-type: none"> • Patriot and THAAD missile exhaustion problem remains
<ul style="list-style-type: none"> • Low Observable Targets 	<ul style="list-style-type: none"> • SHORAD and HIMAD sensors and interceptors 	<ul style="list-style-type: none"> • Patriot <ul style="list-style-type: none"> - Radar enhancement - CDI Phases I and II - PAC-3 missile • Software algorithm improvements 	<ul style="list-style-type: none"> • Difficulty of AMD sensors and missile seekers to detect and acquire all LO targets in clutter at sufficient ranges
<ul style="list-style-type: none"> • Intelligence, Surveillance, and Reconnaissance 	<ul style="list-style-type: none"> • HIMAD RF sensors • Communications equipment • Power generation equipment • All semi static equipment 	<ul style="list-style-type: none"> • Software algorithm improvements 	<ul style="list-style-type: none"> • HIMAD and SHORAD sensors are easily detected • HIMAD/TMD units limited in mobility; must remain in position for extended periods and have significant IR, visual, and acoustic signatures

Far-Term (FY08-16) AD/TMD Survivability Assessment

THREAT	SUSCEPTIBLE/VULNERABLE COMPONENTS	PROGRAMS/TECHNOLOGY SCHEDULED OR AVAILABLE FOR FIELDING DURING THE FAR TERM	REMAINING SURVIVABILITY SHORTFALLS
<ul style="list-style-type: none"> • Anti Radiation Missiles 	<ul style="list-style-type: none"> • Radars: SHORAD, Patriot, and THAAD • Control vans in close proximity to radars 	<ul style="list-style-type: none"> • THAAD radar • MEADS • SWORD • Armicide • Radar Ballistic Shield • Multi static Radar, Passive Sensor • Sentinel • SLID • Software algorithm improvements 	<ul style="list-style-type: none"> • To be determined by the extent of successful development of emerging technologies • Operational issues surrounding use of SWORD, radar ballistic shield, and employment of Armicide
<ul style="list-style-type: none"> • Penetration Aids <ul style="list-style-type: none"> - Electronic Warfare - Decoys - Target Maneuvers 	<ul style="list-style-type: none"> • Radars, sensors, and seekers 	<ul style="list-style-type: none"> • THAAD radar • Stinger Block II • MFS3 as replacement for, or adjunct to Sentinel • MEADS • LADAR • Software algorithm improvements 	<ul style="list-style-type: none"> • To be determined by the extent of successful development of emerging technologies
<ul style="list-style-type: none"> • Nuclear, Biological, and Chemical Weapons 	<ul style="list-style-type: none"> • Personnel • All equipment 	<ul style="list-style-type: none"> • CPE • Catalytic decontaminates <ul style="list-style-type: none"> - Sorbent - Emulsion - Self-Stripping • Radiation hardened electronics • Stand-off chemical detectors 	<ul style="list-style-type: none"> • To be determined by the extent of successful development of emerging technologies
<ul style="list-style-type: none"> • Direct and Indirect Fire 	<ul style="list-style-type: none"> • Personnel • All equipment 	<ul style="list-style-type: none"> • Composite Armor • Radar Ballistic Shield 	<ul style="list-style-type: none"> • AMD systems vulnerability to direct- or indirect-fire attacks should be reduced to an acceptable level.
<ul style="list-style-type: none"> • Helicopters 	<ul style="list-style-type: none"> • All SHORAD systems 	<ul style="list-style-type: none"> • Stinger Block II and/or Extended Range Stinger • HUMRAAM • SWORD • Software algorithm improvements 	<ul style="list-style-type: none"> • To be determined by the extent of successful development of emerging technologies
<ul style="list-style-type: none"> • Cruise Missiles 	<ul style="list-style-type: none"> • HIMAD systems • THAAD radar 	<ul style="list-style-type: none"> • HUMRAAM • MEADS • ECAC • Armicide • SWORD • Software algorithm improvements 	<ul style="list-style-type: none"> • To be determined by the extent of successful development of emerging technologies
<ul style="list-style-type: none"> • Mass Tactical Ballistic Missile Attack 	<ul style="list-style-type: none"> • Personnel • HIMAD systems 	<ul style="list-style-type: none"> • THAAD • MEADS • TMD DEW • TMD (OSS) • Software algorithm improvements 	<ul style="list-style-type: none"> • To be determined by the extent of successful development of emerging technologies
<ul style="list-style-type: none"> • Low Observable Targets 	<ul style="list-style-type: none"> • SHORAD and HIMAD sensors and interceptors 	<ul style="list-style-type: none"> • Stinger Block II • Extended Range Stinger • MEADS • THAAD • Software algorithm improvements 	<ul style="list-style-type: none"> • To be determined by the extent of successful development of emerging technologies
<ul style="list-style-type: none"> • Intelligence, Surveillance, and Reconnaissance 	<ul style="list-style-type: none"> • Active RF sensors • Communications equipment • Power generation equipment • All semi static tactical equipment 	<ul style="list-style-type: none"> • MFS3 adjunct to Sentinel • MEADS • Barracuda • Software algorithm improvements 	<ul style="list-style-type: none"> • AMD system with active sensors remain vulnerable